AMENDMENTS TO THE CLAIMS:

The Listing of Claims below will replace all prior versions and listings of claims in the application.

Listing of Claims:

1. (Original). A fabric and tape laying machine operable with: (a) a mold, plug or mandrel of predetermined surface shape relative to x, y and z coordinates, (b) a supply roll containing a continuous strip of composite tape or fabric, and (c) a robot including programmable control means comprising:

a. a chassis mountable to said robot and movable by said robot for laying said tape or fabric onto said mold along a programmed path that is straight with respect to said x and y coordinates and follows contours of said predetermined surface shape with respect to said z coordinate,

b. means on said chassis for supporting said supply roll,

c. a contact roller module mounted on said chassis and spaced apart and downstream from said supply roll and adapted to receive said tape from said supply roll, said contact roller module being carried by said chassis as said chassis is moved along said programmed path,

d. a tape cutting unit carried by said chassis and situated between said supply roll and said contact roller module,

e. a first set of feed rollers downstream of said supply roll and upstream of said tape cutting unit, and a second set of feed rollers downstream of said tape cutting unit and upstream of said contact roller module for driving said tape from said supply roll and maintaining said tape taut while it passes through said tape cutting unit, and driving said tape to said contact roller module, said tape extending from said supply roll to said tape-cutting unit having opposite generally parallel side edges,

f. said tape-cutting unit comprising at least one cutter to cut a predetermined profile along one of said opposite sides of said tape as said tape is moving through said tape-cutting unit and to cut said tape transversely to have a predetermined length when it covers a predetermined surface area of said mold,

g. said contact roller module comprising at least one modular frame, a set of three pressure contact rollers carried by said at least one said frame, namely a center roller and two side rollers in end-to-end relationships, said at least one set of pressure contact rollers adapted to have said tape received from said tape-cutting unit pass around said pressure contact rollers and be laid onto said mold, and where each of said side rollers has its central axis angularly displaceable relative to the central axis of said central roller, and

h. a suspension system for dynamically energizing said contact roller module to have its rollers apply a predetermined level of force downward on said tape during the lay-up process regardless of any varying contours on said mold surface.

2. (Currently amended). A tape-laying machine according to Claim 1 wherein said contact roller module moves along said programmed path in a forward direction as said tape is laid behind it, and wherein for each contact roller module said pressure contact rollers in end-to-end relationship define between each two adjacent ends of said rollers a gap, said contact roller module further comprises at least one follower element situated adjacent and generally parallel to and behind said pressure contact rollers for contacting and pressing portions of laid-up tape which are adjacent said gap and are not contacted by said pressure contact rollers.

3. (Original). A tape-laying machine according to Claim 1 wherein said tape on said supply roll includes an adjacent strip of protective film, and said chassis further comprises a take-up roll, said protective film being separated from said tape and fed onto said take-up roll.

4. (Original). A tape-laying machine according to Claim 1 wherein said center roller is mounted at a fixed orientation and location on said frame of said contact roller module.

5. (Currently amended). A tape-laying machine according to Claim 2 wherein said gap between adjacent ends of said at least one set of pressure contact rollers has a ~~combined axial~~ length L, and said at least one follower element has axial length substantially the same as L.

6. (Currently Amended). A tape-laying machine according to Claim ~~5~~ 2 wherein said follower element is a roller.

7. (Original). A tape-laying machine according to Claim 1 wherein said tape defines a plane as it extends from said cutting unit to said contact roller module, and wherein said pressure contact rollers of said contact roller module lie in a plane generally perpendicular to said plane of said tape, said center roller positioned with its central axis of rotation a fixed perpendicular distance from said frame and perpendicular to the direction of said tape movement, said side rollers having their respective central axis pivotable relative to said central axis of said center roller, said contact roller module further comprising at least one follower element situated adjacent and generally parallel to and behind said contact pressure rollers with respect to said path traversed by said contact roller module, said at least one follower element pressing said laid tape against said mold.

8. (Currently amended). A tape-laying machine according to Claim ~~7~~ 1 wherein each of said modular frames comprises a base, and wherein said center roller has opposite ends and each of said side rollers has an inner end adjacent one of said opposite ends of said center roller and has an outer end, and wherein said modular frame further comprises (a) a pair of spaced-apart fixed arms which extend from said base and rotatably support said opposite ends of said center roller and pivotably and rotatably support said inner ends of said side rollers, and (b) a pair of length-extendable arms, each having one end pivotably connected to said outer end of each of said side rollers and an opposite end pivotably connected to said base, said side rollers being angularly displaceable relative to said center roller when said length extendible arms are varied in length.

9. (Currently Amended). A tape-laying machine according to Claim ~~7~~ 1 comprising a plurality of said contact roller modules, each having a frame with said three contact pressure rollers in end-to-end configuration with the adjacent frame, and with the outer end of one side roller pivotally coupled to the outer end of the adjacent side roller of the adjacent modular frame, with said end-to-end aligned modular frames forming a first tier of the tape-dispensing head structure.

10. (Original). A tape-laying machine according to Claim 9 wherein each of said frames with its three rollers is a modular sub-assembly with respect to an adjacent frame, with the adjacent side rollers of each two adjacent frames remaining pivotally coupled together such that all the rollers of all the frames always define a continuous line in a single plane.

11. (Original). A tape-laying machine according to Claim 10 wherein each of said length-extendable arms comprises a telescoping piston and cylinder, the piston being axially energized by said control means to configure the aligned rollers to be compliant with said mold surface.

12. (Original). A tape-laying machine according to Claim 8 wherein said tape-dispensing head comprises a base and a plurality of said modular frames fixed to said base and situated such that the central axis of the two outer and center rollers of each modular frame lie in a plane, and said planes of said plurality of modular frames are co-planar, and each of said modular frames is adjacent to at least one other modular frame with the outer ends of one side roller of each of said adjacent modular frames being adjacent and pivotally coupled together, and with said rollers of said plurality of modular frames being configurable so that their respective central axes define a continuous line that may be concave, convex, wavy, sinusoidal or other shape.

13. (Original). A tape-laying machine according to Claim 1 wherein each of said center and side rollers is nominally two inches long.

14. (Currently Amended). A tape-laying machine according to Claim 1 wherein said control means directs the ~~configuration~~ angularly displaceable orientation of the side rollers of each of said modular frames independently of each other and independently of the rollers of the adjacent sub-frames, except that each two adjacent side rollers of adjacent modular frames must remain coupled to each other.

15. (Original). A tape-laying machine according to Claim 1 wherein said predetermined path is defined by successive points, each being at a specified elevation relative to a reference plane, and said predetermined path further defines at each of said points a surface contour defined by a line perpendicular to said path, whereby at each of

said points said chassis frame is controlled to position the center roller on said line and at said specified elevation, and to position said side rollers on both sides adjacent said center roller at an angle and elevational as defined by said path.

16. (Currently Amended). A tape-laying machine according to Claim 1 wherein said chassis frame of said tape dispensing head has top and bottom parts with said tape moving in the direction from top to bottom in a generally flat plane, and said tape-cutting unit further comprises ~~comprising~~ a beam having a cutter support surface generally parallel to said plane of said tape and generally perpendicular to said top-to-bottom direction, and a pair of said cutters, each of said pair of cutters being movable on said support surface transversely of said tape movement direction.

17. (Currently Amended). A tape-laying machine according to Claim 16 wherein said pair of cutters of said tape-cutting unit comprises a pair of knives, water, air or laser cutters, each movable transversely on said beam independently of the other.

18. (Original). A tape-laying machine according to Claim 1 wherein said mold surface defines at least a portion of an airplane wing, fuselage, nacelle or propeller blade, or of a boat hull, automotive body, satellite component, windmill blade or building component.

19. (Original). A tape-laying machine according to Claim 1 wherein said supply roll can be replaced or supplemented between passes of the tape-dispensing head so that the tape laying can be continuous regardless of the length or the breadth of the mold onto which it is laid.

20. (Currently Amended). A tape-laying machine according to Claim 1 further comprising a heater for heating said tape after is passes said tape-cutting ~~sub-assembly~~ unit and before it reaches said contact roller module.

21. (Currently Amended). A tape-laying machine according to Claim 1 further comprising a cooler for maintaining cool said tape on said supply roll and said fabric tape extending from said supply roll to said ~~contact roller module~~ cutting unit.

22. (Currently Amended). A method of performing composite fabric or tape lay-up onto a mold surface with a tape laying machine that uses a supply roll of composite

tape and includes a tape cutting unit and a contact roller module having a set of end-to-end relationship and around which said tape from said supply roll is directed to be laid-up onto said mold, comprising the steps:

a. defining the topography of said mold surface,

b. directing a contact roller module to traverse a plurality of successive passes, each pass generally parallel to and laterally displaced from the prior pass, where each pass follows a path which defines a portion of said topography, and

c. providing a dynamic suspension system which urges pressure contact rollers of said contact roller module to push against said mold surface with substantially the same force at all times regardless of the changes in topography of the mold as the contact roller module passes are made.

23. (Original). A method according to Claim 22 comprising the further step of each strip dispenses with each pass of said tape dispensing head,

a. determining the profiles of opposite side edges profile and the length of each strip should have before said contact roller modules makes the pass,

b. directing said tape cutting unit to cut said edge profiles as said tape is moving toward said mold, and to make a transverse cut across said tape to establish the predetermined strip length.

24. (New). A tape dispensing head operable with: (a) a mold of predetermined surface shape defined by x, y and z coordinates corresponding to length width and elevation respectively, (b) a supply roll containing a continuous strip of tape having opposite side edges, and (c) a robot including programmable control means for directing said robot to follow a path corresponding to said predetermine surface shape at a predetermined off-set distance therefrom to lay-up said tape onto said mold, comprising:

a. a chassis mountable to said robot and movable by said robot for placement of said tape onto said mold along said programmed path that is straight with respect to said x and y coordinates, while remaining generally perpendicular along said z coordinate to said mold surface at every point along said path,

b. means on said chassis for supporting said supply roll,

c. at least one contact roller module mounted on said chassis and spaced apart and downstream from said supply roll and adapted to receive said tape from said supply roll, said contact roller module being carried by said chassis as said chassis is moved along said programmed path,

d. a tape cutting unit carried by said chassis and situated between said supply roll and said contact roller module,

e. a first set of feed rollers downstream of said supply roll and upstream of said tape cutting unit, and

f. a second set of feed rollers downstream of said tape cutting unit and upstream of said contact roller module for pulling said tape from said supply roll and maintaining said tape taut while it passes through said tape cutting unit, and driving said tape to said contact roller module,

said tape cutting unit comprising at least one cutter to cut a predetermined profile along at least one of said opposite side edges of said tape as said tape is moving through said tape cutting unit,

said at least one contact roller module comprising: (i) a frame, and (ii) a set of three pressure contact rollers carried by said frame, namely a center roller and two outboard rollers in end-to-end relationship, each of said rollers having a central axis of rotation, said set of pressure contact rollers adapted to have said tape received from said tape cutting unit pass around said pressure contact rollers and be laid-up onto said mold, and where each of said outboard rollers has its central axis angularly displaceable relative to the central axis of said central roller,

said tape dispenser head further comprising a suspension system for dynamically energizing said contact roller module to have its contact rollers apply a predetermined level of force onto said tape during said lay-up process, regardless of any contours on said mold surface varying in the z-axis from said programmed path.

25. (New). Apparatus according to claim 24 wherein said predetermined level of force is a predetermined range of force.

26. (New). Apparatus according to claim 24 wherein said suspension system operates in cooperation with said control means and is adapted:

a. to position said tape dispensing head such that each of said pressure contact rollers is nominally in contact with and is applying a force within a predetermined range of force against said tape being placed on said predetermined surface shape, and

b. to maintain said force within said predetermined range of said pressure contact roller against said predetermined surface of said mold in said z-direction perpendicular to said surface regardless of any changing orientation of said predetermined surface shape as said tape dispensing head is moved along said predetermined path and maintained generally perpendicular thereto.

27. (New). Apparatus according to claim 25, wherein said spring means is selected from the group consisting of mechanical, hydraulic and electrical spring means.

28. (New). Apparatus according to claim 24, wherein said programmable control means controls said robot to position said tape dispensing head so that said central pressure contact roller is at a predetermined offset distance in the z-direction from said robot, and by said suspension system said pressure contact roller and said outboard rollers apply a force within said predetermined range of force against said tape laid-up onto said mold.

29. (New). Apparatus according to claim 24, wherein said at least one contact roller module is movable by said robot in the x,y plane in a direction designated upstream along said predetermined path, with said tape being laid and extending behind and downstream of said contact roller module, said contact roller module further comprising an idler roller mounted on said contact roller module and positioned upstream of said contact pressure rollers of said contact roller module, whereby said tape fed from said tape cutting unit is directed to go forward of and around said idler roller, thus making a generally 90 degree turn, and thence to go beneath said pressure contact rollers as it is laid onto said mold.

30. (New). Apparatus according to claim 29, wherein said second set of feed rollers upstream of said contact roller module directs said tape without being in tension to

go around said idler roller and to contact said predetermined surface.

31. (New). Apparatus according to claim 24, wherein said tape dispensing head comprises at least one additional contact roller module coupled to said at least one contact roller module, with said contact pressure rollers of all said contact roller modules being coupled in end-to-end relationship along a single axis, each roller being angularly displaceable relative to the adjacent roller, so that said single axis may become curved when any of said contact pressure rollers become angulated relative to the others.

32. (New). Apparatus according to claim 24, wherein said tape cutting unit is adapted to cut said tape transversely to produce a segment of tape having a predetermined length as it is directed to said contact roller module.

33. (New). Apparatus according to claim 24, wherein for each contact roller module said pressure contact rollers in end-to-end relationship define between each two adjacent ends of said rollers a gap, each of said contact roller modules further comprising at least one follower element carried by said frame and situated adjacent and generally parallel to and behind said pressure contact rollers for contacting and pressing portions of tape which are adjacent said gap and are not contacted by said pressure contact rollers.

34. (New). Apparatus according to claim 33 wherein each of said follower elements comprises a roller rotably mounted on said frame.

35. (New). Apparatus according to Claim 24, wherein each of said modular frames comprises a base, and wherein said center roller has opposite ends and each of said side rollers has an inner end adjacent one of said opposite ends of said center roller and has an outer end, and wherein said modular frame further comprises (a) a pair of spaced-apart fixed arms which extend from said base and rotatably support said opposite ends of said center roller and pivotably and rotatably support said inner ends of said side rollers, and (b) a pair of length-extendable arms, each having one end pivotably connected to said outer end of each of said side rollers and an opposite end pivotably connected to said base, said side rollers being angularly displaceable relative to said center roller when said length extendible arms are varied in length.

36. (New). Apparatus according to Claim 24, comprising a plurality of said

contact roller modules, each having a frame with said three contact pressure rollers in end-to-end configuration with the adjacent frame, and with the outer end of one side roller pivotally coupled to the outer end of the adjacent side roller of the adjacent modular frame, with said end-to-end aligned modular frames forming a first tier of the tape-dispensing head structure.

37. (New). Apparatus according to Claim 24, wherein said tape-dispensing head comprises a base and a plurality of said modular frames fixed to said base and situated such that the central axis of the two outer and center rollers of each modular frame lie in a plane, and said planes of said plurality of modular frames are co-planar, and each of said modular frames is adjacent to at least one other modular frame with the outer ends of one side roller of each of said adjacent modular frames being adjacent and pivotally coupled together, and with said rollers of said plurality of modular frames being configurable so that their respective central axes define a continuous line that may be concave, convex or wavy sinusoidal shape.

38. (New). Apparatus according to Claim 24, wherein said chassis frame of said tape dispensing head has top and bottom parts with said tape moving in the direction from top to bottom in a generally flat plane, and said tape-cutting unit further comprises a beam having a cutter support surface generally parallel to said plane of said tape and generally perpendicular to said top-to-bottom direction, and a pair of said cutters, each of said pair of cutters being movable on said support surface transversely of said tape movement direction.

39. (New). Apparatus according to Claim 24, (a) further comprising a heater for heating said tape after is passes said tape-cutting unit and before it reaches said contact roller module, and (b) further comprising a cooler for maintaining cool said tape on said supply roll and said fabric tape extending from said supply roll to said cutting unit.

40. (New). A method for performing lay-up of composite tape onto a mold having a predetermined surface topography defined by x, y and z coordinates which correspond to width, length and elevation dimension respectively of said mold,

said method operable with a robot having programmable control means

said tape being laid-up along a programmed path established by said robot where the coordinates at every point along said programmed path correspond to points on said surface of said mold,

said robot adapted to carry a tape dispensing head which includes a supply roll containing a continuous strip of said tape and further includes at least one contact roller module having pressure contact rollers around which said tape from said supply roll is extended and urged by said rollers onto said mold surface,

said method comprising the steps:

a. positioning said contact roller module such that the surfaces of said contact rollers engage and apply said tape from said supply roll onto said mold surface,

b. directing said contact roller module to traverse a plurality of successive passes each pass being straight and generally parallel to and laterally displaced from the prior pass, where each pass is a portion of said programmed path, and

c. providing a spring pressure force feed back suspension system which positions said pressure contact rollers of said contact roller module to contact and press said tape against said mold with a predetermined level of force at all times as said rollers move along said path.

41. (New). A method according to claim 40, wherein said level of force of said suspension system comprises a range of force.

42. (New). A method according to claim 40, where each of said passes of said contact roller modules is axially in the y-direction, with each of said contact pressure rollers (i) extending along the x-axis transverse of said y-axis, and (ii) movable by said dynamic suspension system in said z-direction while in the x,z plane, and said suspension system allows any number of said contact pressure rollers of said contact roller modules to move in said z-direction while in said x,z plane while said module moves in said y direction during any of said passes.

43. (New). A method according to claim 40, wherein said suspension system utilizes springs selected from the group consisting of mechanical, hydraulic and electronic springs.

44. (New). A method according to claim 40, wherein said suspension system senses each change in distance of each of said rollers from the robot due to a variation in the mold topography and maintains substantially the same force along the z-axis of the roller onto the tape.

45. (New). A method according to claim 40, wherein each contact roller module comprises a central roller and an outboard roller at each end of said central roller, said outboard rollers arranged coaxially with said central roller and angularly displaceable therefrom and said system comprises a separate spring element associated with each roller for maintaining the force on each roller in its various positions independently of every other roller.

46. (New). A method according to claim 40 comprising the further steps:

a. providing a tape cutting unit between said tape supply roll and said contact roller module,

b. directing said tape from said tape supply roll to said cutting unit and thence to said contact roller module, and

c. with said cutting unit, cutting a predetermined profile along each of said side edges of said tape where said predetermined profile corresponds to a predetermined area of said mold topography to be covered when said tape is laid-up onto said mold,

47. (New). A method according to claim 46 wherein said tape moves along its longitudinal y-axis while moving through said cutting unit, and wherein cutting each of said profiles on said side edges of said tape comprises moving a cutting element transversely of said y-axis.

48. (New). A method according to Claim 40 comprising the further step of maintaining the temperature of said composite below the melting temperature thereof while said tape is on said supply roll and in said cutting unit.

49. (New). A method according to claim 40 comprising the further step of heating said tape to a temperature above its melting temperature while said tape moves from said cutting unit to said pressure roller module.

50. (New). A method according to claim 41 wherein said suspension system positions said contact roller module to apply said force by said rollers onto said tape in a direction perpendicular to said mold at all times that said rollers move along said path.